

The Influence of Age, Health Literacy, and Affluence on Adolescents' Capacity to Consent to Research

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Abstract

While adults are assumed to have the capacity to consent to medical research, and young children to have no capacity, adolescents' capacity to consent is not well described. Adapting the MacArthur Competence Assessment Tool for Clinical Research (MacCAT-CR), we describe adolescents' capacity to consent to medical research and factors influencing that capacity. Our pilot study included a community-based sample of 30 adolescents, 14 to 21 years of age, who completed the MacCAT-CR after undergoing a simulated informed consent process. We found that adolescents' capacity to consent to research was associated with age, health literacy, and family affluence. These findings suggest that investigators and institutional review boards should be aware that factors other than age may influence capacity to consent, and, for modifiable factors, such as health literacy, consent processes for medical research with adolescents can be modified.

Keywords

adolescent, consent, socioeconomic status, health literacy, bioethics, capacity

This is the author's manuscript of the article published in final edited form as:

Nelson, L. R., Stupiansky, N. W., & Ott, M. A. (2016). The Influence of Age, Health Literacy, and Affluence on Adolescents' Capacity to Consent to Research. *Journal of Empirical Research on Human Research Ethics*, 11(2), 115–121. <https://doi.org/10.1177/1556264616636232>

Introduction

The capacity to understand and consent to research has been identified as a potential vulnerability of child and adolescent research participants (Kipnis, 2003). While adults are generally assumed to have the capacity to consent to research, and young children to not have capacity, limited data guide research consent with adolescents. For situations in which adolescents should give self-consent, the Society for Adolescent Health and Medicine Guidelines recommend adolescent self-consent for lower risk research and a capacity assessment prior to self-consent for higher risk research (Santelli et al., 2003). However, no capacity assessment tools have been developed to capture the evolving cognitive abilities of adolescent research participants. The purpose of this study was to (a) adapt an adult capacity assessment tool to adolescents; (b) using the tool, describe the capacity to consent to research among healthy adolescents, and (c) examine developmental influences on adolescents' capacity to consent to research.

Elements of research decision-making capacity include the ability to (a) understand the research project, including purpose, risks, benefits, and procedures; (b) appreciate one's own situation and how that might be affected by research participation; (c) rationally manipulate the above information; and (d) communicate a choice (Appelbaum & Grisso, 1995). In adult medicine, this framework has been operationalized into a capacity assessment tool, the MacArthur Competence Assessment Tool for Clinical Research (MacCAT-CR). The MacCAT-CR has been tested across a range of cognitively normal and impaired adult populations, including dementia, psychiatric illness, HIV, and common medical illnesses (e.g., diabetes; Appelbaum, Grisso, Frank, O'Donnell, & Kupfer, 1999; Candilis, Fletcher, Geppert, Lidz, & Appelbaum, 2008; Fisher et al., 2012; Nathan et al., 2010; Stroup et al., 2005). The MacCAT-CR has shown reasonable variability and ability to differentiate among individuals with and without capacity to consent (Dunn et al., 2007; Kim et al., 2007). Adult studies using the MacCAT-CR have also described associations between capacity and factors such as age and health literacy (Casarett, Karlawish, & Hirschman, 2003).

While a number of alternative assessment tools exist to assess adult patients' competence to consent to research (Sturman, 2005), we selected the MacCAT-CR to adapt for adolescents because it is comprehensive and captures all four domains of consent, has been successfully used across a variety of both cognitively normal and abnormal adult populations, and has emerging data in children (Koelch, Prestal, Singer, Schulze, & Fegert, 2010). The MacCAT-CR was designed specifically for research purposes, and its semi-structured format allows investigators to examine not just scores but also the types and patterns of responses, and is straightforward enough that a research staff person with adequate training to administer.

However, it is not clear that the MacCAT-CR and other capacity assessment tools, mostly designed for adults with waning capacity, can be directly used with developing adolescents without modifications. The normal developmental processes leading to increased capacity during adolescence are different than the processes that occur with waning capacity due to disease or illness. Generally, adults with waning capacity have pathologic processes and disease states that influence specific aspects of decision making. Capacity assessment tools have been designed for adults with severe mental illness and dementia, which result in decision-making deficits such as memory impairment, impaired global intelligence, and delusions (Palmer et al., 2005). In contrast, a developing adolescent may experience decision-making difficulties due to inexperience, distraction, or high emotion (Blakemore &

Robbins, 2012). Thus, one cannot abstract adult data on waning capacity to adolescents with evolving capacity, and it does not follow that a tool that is effective in measuring waning capacity among adults can be applied in exactly the same way to adolescents.

For adolescent research participants, there is limited data on capacity assessment in research. Research on adolescent cognition demonstrates that organization, reasoning, and executive decision-making skills emerge and continue to improve across adolescence and into adulthood (Blakemore & Robbins, 2012; Luna, Garver, Urban, Lazar, & Sweeney, 2004; Steinberg, 2008; Waber et al., 2007). General adolescent decision-making research suggests that the skills necessary for informed consent, including the ability to accurately perceive risks, logically weigh risks and benefits, and simultaneously consider multiple possibilities and their potential future consequences, emerge and develop as an adolescent transitions into adulthood (Luna et al., 2004; Millstein & Halpern-Felsher, 2002; Reyna & Rivers, 2008; Steinberg, 2008; Waber et al., 2007). When compared directly with adults, adolescents' cognitive capacity differs in several areas relevant to research decision making. Adolescent decision making is more likely to be influenced by social factors, such as distraction by peers, and emotion (Blakemore & Robbins, 2012). Factors that affect adolescent decision making include socioeconomic status (SES), education, and life experience (Hackman, Farah, & Meaney, 2010). Health literacy, similarly, is closely associated with cognitive ability (Manganello, 2008) and has direct implications for capacity to consent to research.

An additional advantage of the MacCAT is that there are relevant pediatric and adolescent data. For adolescents, the MacCAT tools for treatment and criminal adjudication have both been adapted for adolescent populations. The MacCAT-CA (criminal adjudication) has been used extensively with adolescents to describe capacity to stand trial and has shown hypothesized differences in capacity to consent by age, with adolescents 15 and older demonstrating adult-level capacity (Grisso et al., 2003). The MacCAT-T (treatment) has been used to examine capacity differences between young women with eating disorders and health controls (Turrell, Peterson-Badali, & Katzman, 2011). For research purposes, there are emerging data on the use of the MacCAT-CR with adolescent populations. A recent study of children with acute and chronic illness enrolling in clinical trials demonstrated feasibility and acceptability with a MacCAT-CR modified for younger participants, and concluded that many participants had adequate capacity to consent to medical research by 10 to 11 years of age (Hein et al., 2014). Other studies have examined school-aged children with attention deficit hyperactivity disorder (ADHD), a condition that affects decision capacity because of its effects on inattention and distractibility (Koelch, Prestal, Singer, Schulze, & Fegert, 2010). These studies did not examine adolescent populations separately, nor did they examine developmental differences in capacity based on age, grade, literacy, or other standards (Koelch et al., 2010). The purpose of this study was to adapt an adult tool for assessment of capacity to consent, to adolescent populations, and to examine predictors of capacity among a healthy community-based adolescent sample. Our study examines the utility on the application of the MacCAT-CR as a tool to assess developing adolescents, specifically 14 to 21 years of age in our study, in research.

Method

Participants

We recruited 30 adolescents, ranging in age from 14 to 21, from outpatient clinics and community-based settings, with the goal of recruiting across a range of sociodemographic characteristics and life experiences. Research staff contacted teachers and school administrators, youth program directors, youth workers, physicians, and clinic administrators, and asked permission to recruit youth in these different community sites. The upper age was chosen because the American Academy of Pediatrics defines adolescence to 21 years. The lower age was chosen for pragmatic reasons—because of Indiana-mandated reporting laws, it is the lower age in which adolescents typically are allowed to self-consent for risk behavior research.

Procedures

Adolescent research participants were first asked to complete a short survey that covered basic demographic and behavioral information. Once the survey was completed, the participants completed a Rapid Estimate of Adult Literacy in Medicine (REALM) health literacy assessment (Arozullah et al., 2007). After the REALM, the participant underwent three separate simulated consent processes for the three different studies (see below).

Participants completed simulated consent processes for three different research protocols. The three different studies included a biobanking study, STI (sexually transmitted illness) screening study, and a pharmaceutical clinical trial of a migraine medication. These three studies were selected because they encompass the range of research that adolescents might be asked to participate in (epidemiologic research, genetic research, pharmaceutical clinical trial) and also represent a range of research risk. Two of the studies, the biobanking and STI screening study, used the actual consent forms from existing studies. The third study, the pharmaceutical clinical trial, is a hypothetical study with information adapted from an existing clinical trial of a migraine medication and presented in a standardized Phase III trial consent form from the Indiana University Institutional Review Board (IRB). The STI screening study identifies the community-based prevalence of gonorrhea and chlamydia and procedures involved in a behavioral survey and urine specimen for STI testing. The biobanking study involved a brief demographic survey, permission to link data to a participants' electronic medical record, and the collection of a blood sample from the participant that would be kept indefinitely for future research studies and the development of future treatments. The pharmaceutical study examined the efficacy of a new migraine medication versus placebo in an adolescent population. This study included the procedures involved to study the medication, blood draws, and symptoms related to the medication.

The research staff explained to participants that they would go through a simulated consent process as if they were actually considering participation in each of the three studies. The simulated consent processes involved providing the participant with a consent form to read through, trained research staff reviewing the consent form section by section in the same manner used for actual research studies, providing the participant with the opportunity to ask questions, and then completing a MacCAT-CR. The researcher scored the adolescent's responses to the questions during this process using the MacCAT-CR rubric for scoring. The consent process was similar to the processes used for the actual studies, and all research staff trained with an adolescent clinical research supervisor in consent techniques. The order of the three simulated consent processes was randomly determined.

The MacCAT-CR and Adaptations

The MacCAT-CR typically follows the consent process. It includes a summary of the consent information followed by questions, effectively providing participants with the relevant information twice (once during the consent process and once during the MacCAT-CR). On debriefing after completing study procedures, the first 11 participants identified repeating the study information twice as excessively repetitive and distracting, and asked that we not repeat information so many times. In response, we embedded the MacCAT-CR questions into the consent process, asking the MacCAT-CR questions after each section. The adaptation made it much easier to maintain adolescent participants' continued engagement and attention. A second adaptation was to ask adolescents to explain their answers when they repeated information from the consent form. We observed that adolescents had no problem remembering terms, but often had not heard the term before and did not know what it meant. For example, we found frequent misunderstandings of commonly used descriptors such as "flip of a coin" for randomization and "sugar pill" for placebo (these terms are used in the Indiana University IRB-approved consent form templates). Research procedures were also adapted for adolescents. We observed that older participants seemed actively engaged throughout the interview process, whereas very young adolescent participants often lost attention, necessitating the introduction of periodic breaks for all participants.

Measures

Demographic information included age, gender, ethnicity, grade, and family SES. The Family Affluence Scale (FAS II) was used to determine family SES. The FAS II was developed specifically for adolescent populations and includes four questions that an adolescent would know the answer to, including the number of vehicles a family owns, whether the adolescent has their own bedroom, the number of times the adolescent has traveled in the past 12 months, and the number of computers their family owns (Boyce, Torsheim, Currie, & Zambon, 2006). The FAS II scores range from 0 to 9 with scores of 6 to 9 classified as high, 3 to 5 as medium, and 0 to 2 as low affluence.

Health Literacy was assessed using the REALM. The REALM has been validated in adolescent populations, and scores correlate strongly with the SORT-R (Slosson Oral Reading Test-Revised) and WRAT-3 (Wide Range Achievement Test-Revised) literacy tests. The REALM test is an ideal literacy measure in adolescents Grades 6 to 12 because of its easy administration, reliability, and ability to compare adolescents with adult populations (Davis et al., 2006). Scores of 61 to 66 are considered as high school reading level, 45 to 60 seventh to eighth grade, 19 to 44 fourth to sixth grade, and 0 to 18 third grade or below reading level (Davis et al., 1993).

The MacCAT-CR assessed capacity to consent to participation in a research study. The MacCAT-CR is a 23-question semi-structured interview broken down into four sections. (a) *Understanding* assessed participants' understanding of the purpose, procedures, risks, and benefits of a study (13 items for randomized clinical trials and 10 items for STI and biobank studies; example question: "What is the purpose of the study?"); (b) *Appreciation* assessed a participant's ability to appreciate their own situation with regard to study participation (three items; example question: "Would you personally benefit from the research study?"). Of

particular concern with research participation is assessing whether the participant understands that research is done for knowledge, and not the personal benefit of the participant. (c) *Reasoning* focuses on identifying risks and reasons they would want to participate in the study (four items; example question: “Why or why do you not want to participate in this research study?”); and (d) *Expressing a Choice* is a single item assessing whether or not the participant recognized that he or she does not have to participate in the research study.

Questions were coded as a 2 (completely answers the question), 1 (partially answers the question), and 0 (does not answer the question). Acceptable answers were defined prior to coding based on the specific study information provided in the informed consent process. For example, in the pharmaceutical Phase III clinical trial, the participant must say that the purpose is to test the safety of the medication and to determine how well that medication works to receive 2 points.

Data Analysis

The three subscales of the MacCAT-CR (Understanding, Appreciation, Reasoning) were analyzed separately. For each simulated consent (STI, biobanking, pharmaceutical RCT (Randomized Controlled Trial)), we started with frequencies and bivariate analyses for participant characteristics and the MacCAT-CR subscales. We then ran separate regressions examining the influence of the variables positive in bivariate analysis. For example, we ran age, family affluence, and health literacy on the Understanding, Appreciation, and Reasoning subscales of the MacCAT-CR. Because we found similar direction and strength of results across all three studies (STI, biobank, and pharmaceutical RCT), we report combined data for understanding, appreciation, reasoning, and choice. For the combined understanding, we added the understanding scores from all three studies (STI, biobank, RCT). A similar approach was used for reasoning and appreciation. After quantitative coding, we then examined the interview data qualitatively, looking for patterns of missed responses.

Results

Participants

We interviewed 30 adolescents (24 female and six male) from the age of 14 to 21 with a mean age of 17. Our study included 13 Caucasian, 15 African American, and two Latino participants (see Table 1). The average Family Affluence II Scale (FAS) score was 5.87 (range = 4-9), at the upper end of the medium affluence range. The average REALM score was 61.5 out of 66 (range = 48-66), at the lower end of the high school reading level (61).

Predictors of Capacity

Multiple linear regression models (Table 2) show that age, family affluence, and health literacy are all positively associated with the MacCAT-CR subscales of

Table 1. Demographics.

Characteristics (<i>n</i> = 30)	
Age, range (<i>M</i>)	14-21 (17)
Female, <i>n</i> (%)	24 (80%)
Caucasian, <i>n</i> (%)	13 (43%)
African American, <i>n</i> (%)	15 (50%)
Latino, <i>n</i> (%)	2 (7%)
Family Affluence (FAS II), <i>M</i> (<i>SD</i>)	5.87 (1.85)
Low SES: 0-2; Mid: 3-5; High: 6-9	
Health Literacy (REALM), <i>M</i> (<i>SD</i>)	61.5 (4.73)
High School: 61-66; 7-8th: 45-60; 4-6th: 19-44; 3rd and below: 0-18	

Note. FAS II = Family Affluence Scale II; SES = socioeconomic status; REALM = Rapid Estimate of Adult Literacy in Medicine.

Understanding, Appreciation, and Reasoning. In the multivariate model, participants' older age, higher family affluence, and higher health literacy are each independent predictors of higher understanding, appreciation, and reasoning on the MacCAT-CR. Health literacy was the strongest predictor of an adolescent's ability to reason and appreciate research. Although combined data are presented in Table 2, these findings were similar when linear regressions were run for each study (STI, biobank, RCT) individually.

Qualitative Observations

When we examined the data for patterns of missed responses, we found two types of missed responses common. In the pharmaceutical trial, many adolescents reported the purpose as efficacy alone, rather than efficacy and safety. Based on this observation, we analyzed the effect of age, health literacy, and affluence upon their understanding of the purpose of the pharmaceutical RCT. We conclude that health literacy was associated with their understanding of purpose more than the other variables. Second, although all adolescents in our study could identify that they had a choice in participating in the study, none of the adolescents could recall the necessary steps to leave the studies if he or she were to begin the study.

Discussion

Overall, the adolescents in our study demonstrated the following: (a) an understanding of research purpose, procedures, and risks; (b) the ability to appreciate how the research would affect them personally; (c) the ability to reason, including balancing risks and benefits; and (d) an understanding that they had a choice to participate. Our findings are consistent with MacCAT results in healthy adults and adults with chronic medical illness (e.g., diabetes), and

suggest that our adolescent participants likely had similar levels of capacity to consent to clinical research.

Although mean understanding, reasoning, and appreciation scores were similar to adults, we did observe

Table 2. Predictors of MacCAT-CR Understanding, Appreciation, and Reasoning Scores.

	Coefficients			
	SE	β	<i>t</i>	Significance
Understanding	.175		−0.47	.64
Age	.007	.439	2.86	.01
FAS score	.007	.315	2.41	.02
REALM	.213	.341	2.22	.04
Appreciation	.183		−2.40	.02
Age	.007	.387	2.95	.01
FAS score	.007	.259	2.32	.03
REALM	.223	.510	3.90	.001
Reasoning	.174		−3.14	.004
Age	.007	.446	3.71	.001
FAS score	.007	.352	3.44	.002
REALM	.212	.452	3.754	.001

Note. MacCAT-CR = Macarthur Competence Assessment Tool for Clinical Research; FAS = Family Affluence Scale; REALM = Rapid Estimate of Adult Literacy in Medicine.

statistically significant changes with age, with older adolescents scoring higher than younger adolescents. However, even younger adolescents in our study (14- to 17-year-olds) scored in a range similar to adults. The effect size of age was small to moderate. In addition, age was only one of several independent predictors of MacCAT-CR score. Other important predictors were health literacy and SES. Current research regulations (U.S. Department of Health & Human Services, 2005) use age as the main determinant of whether or not an adolescent is allowed to consent on their own to research; our research supports the use of age as only one of several important influences on adolescent capacity. These findings suggest that more factors should be considered other than age.

Health literacy was an important predictor of higher capacity scores. This finding is consistent with research on adult's capacity to consent to cancer research clinical trials (Cox, 2001). Although the Cox study did not use the MacCAT-CR, it did examine important components of a person's capacity to consent to research. Cox's participants found medical information difficult to read, and that the participants' motivation and anxiety about reading the medical information played a part in overall understanding and ability to consent to research (Cox, 2001). Literacy plays a critical role in a person's ability to fully comprehend health information, especially when the reading contains technical medical terminology. In our study,

health literacy was a significant predictor of higher levels of all three subscales—Understanding, Appreciation, and Reasoning. As with adults, appreciation and reasoning are as important as understanding the information presented to decisional capacity to consent to research.

SES was similarly a predictor of higher scores in three domains, including adolescent's capacity to understand, appreciate, and reason about clinical research. This finding is consistent with the developmental literature. A family's SES can have major implications on a child's cognitive abilities. SES has been associated with literacy and verbal skills, cognitive function, and even increases in gray matter structures (Jednorog et al., 2012).

In conclusion, the MacCAT-CR, with adaptations specific to adolescents, is feasible, shows good variation, and demonstrates significant associations with health literacy and SES. It is a potential tool for the assessment of adolescent capacity in situations where they might need to consent for themselves.

Best Practices

Our study suggests that it is feasible to adapt an adult capacity assessment tool for adolescents, and that the tool is sufficiently sensitive to show differences in capacity based on factors such as age, socioeconomic status, and health literacy. There are a number of research situations in which parental consent may be impractical or introduce additional harms, and adolescent self-consent is preferred. These include certain types of minimal risk community-based research when parents are not available, and sensitive topics research, such as HIV prevention research, in which parental consent requirements can “out” not only high-risk sexual behaviors, but also sexual orientation. Our research suggests that a healthy community-based sample of adolescents can self-consent. In facilitating adolescent self-consent, both individual adolescents and adolescents as a group are provided access to the benefits of research, an issue of justice (Caskey & Rosenthal, 2005; Flicker & Guta, 2008; Sancj, Sawyer, Weller, Bond, & Patton, 2004).

Research Agenda

Our next step is to expand the research to include more adolescents as well as explore the lower age limit. Although Hein et al. (2014) recruited children as young as 9 years old, they markedly simplified the MacCAT-CR and consent. An expanded sample size will provide additional power to consider multiple simultaneous influences, and recruitment of younger aged participants will allow us to examine whether there is a lower age cutoff in a child's ability to understand, appreciate, and reason. In addition, we will examine whether consent processes can be enhanced to address modifiable factors, such as health literacy, to improve the quality of adolescent consent.

Educational Implications

While it is critical to protect adolescents' vulnerabilities, it is also important to support adolescents' emerging capacity, and to understand the multiple influences on capacity. Our results suggest that IRBs may want to consider additional factors beyond age, such as health

literacy, when considering whether to allow adolescent participants to self-consent in research.

Authors' Note

An earlier version of this analysis was presented as a poster at the Pediatric Academic Societies Annual Meeting in Vancouver, Canada on May 5, 2014.

Acknowledgment

We would like to acknowledge the efforts of research staff member Elizabeth Molnar and student Ashley Lewis, for their efforts in the initial design and piloting of the instruments.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The research was supported in part by the Indiana University Center for Bioethics. Mr. Nelson was a participant in the Society for Pediatric Research (SPR) summer student program, and received support from the Section of Adolescent Medicine, Indiana University Department of Pediatrics (a Leadership Education in Adolescent Health grant recipient, HRSA/MCHB T7100008).

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